

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平10-23092

(43) 公開日 平成10年(1998) 1月23日

(51) Int.Cl. ⁶	識別記号	庁内整理番号	F I	技術表示箇所
H 0 4 L 27/22			H 0 4 L 27/22	Z
27/38			27/00	G

審査請求 未請求 請求項の数 2 O L (全 5 頁)

(21) 出願番号 特願平8-169207

(22) 出願日 平成 8 年 (1996) 6 月 28 日

(71) 出願人 390005175

株式会社アドバンテスト

東京都練馬区旭町 1 丁目 32 番 1 号

(72) 発明者 志村 隆史

東京都練馬区旭町 1 丁目 32 番 1 号 株式会

社アドバンテスト内

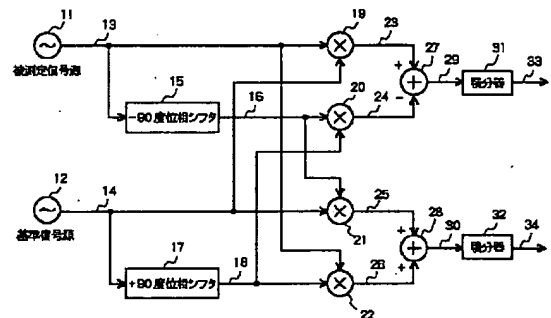
(74) 代理人 弁理士 若林 忠

(54) 【発明の名称】 直交検波器

(57) 【要約】

【課題】 直交検波器において、フィルタを使用せずに和の信号を除去する。

【解決手段】 被測定信号源 11 の出力信号 13 と、基準信号源 12 の出力信号 14 は乗算器 19 で、出力信号 13 を -90° 度位相シフトした信号 16 と、出力信号 14 を $+90^\circ$ 度位相シフトした信号 18 は乗算器 20 で、出力信号 16 と 14 は乗算器 21 で、出力信号 13 と 18 は乗算器 22 で乗算される。乗算器 19 の出力信号 23 と乗算器 20 の出力信号 24 の差信号が加算器 27 で求められ、積分器 31 に入力される。乗算器 21 の出力信号 25 と乗算器 22 の出力信号 26 の和信号が加算器 28 で求められ、積分器 32 に入力される。



【特許請求の範囲】

【請求項1】 被測定信号源の出力信号の位相を -90 度シフトする -90 度位相シフタと、

基準信号源の出力信号の位相を $+90$ 度シフトする $+90$ 度位相シフタと、

前記被測定信号源の出力信号と前記基準信号源の出力信号を乗算する第1の乗算器と、

前記 -90 度位相シフタの出力信号と前記 $+90$ 度位相シフタの出力信号を乗算する第2の乗算器と、

前記 -90 度位相シフタの出力信号と前記基準信号源の出力信号を乗算する第3の乗算器と、

前記被測定信号源の出力信号と前記 $+90$ 度位相シフタの出力信号を乗算する第4の乗算器と、

第1の乗算器の出力信号と第2の乗算器の出力信号の差信号を出力する第1の加算器と、

第3の乗算器の出力信号と第4の乗算器の出力信号の和信号を出力する第2の加算器と、

第1の加算器の出力信号を平均化する第1の積分器と、

第2の加算器の出力信号を平均化する第2の積分器を有する直交検波器。

【請求項2】 被測定信号源の出力信号の位相を -90 度シフトする第1の -90 度位相シフタと、

基準信号源の出力信号の位相を -90 度シフトする第2の -90 度位相シフタと、

前記被測定信号源の出力信号と前記基準信号源の出力信号を乗算する第1の乗算器と、

前記第1の -90 度位相シフタの出力信号と前記第2の -90 度位相シフタの出力信号を乗算する第2の乗算器と、

前記第1の -90 度位相シフタの出力信号と前記基準信号源の出力信号を乗算する第3の乗算器と、

前記被測定信号源の出力信号と前記第2の -90 度位相シフタの出力信号を乗算する第4の乗算器と、

第1の乗算器の出力信号と第2の乗算器の出力信号の和信号を出力する第1の加算器と、

第3の乗算器の出力信号と第4の乗算器の出力信号の差信号を出力する第2の加算器と、

第1の加算器の出力信号を平均化する第1の積分器と、

第2の加算器の出力信号を平均化する第2の積分器を有する直交検波器。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、振幅、位相の測定に用いられる直交検波器に関する。

【0002】

【従来の技術】図2は従来の直交検波器の構成図である。

【0003】被測定信号源41と同じ周波数の基準信号源42がある。基準信号源42の出力信号44は、乗算器47に入力される信号と、 $+90$ 度位相シフタ45に

よって $+90$ 度位相がシフトされた出力信号46に分配される。

【0004】被測定信号源41の出力信号43と、基準信号源42の出力信号44は、乗算器47において乗算され、その出力信号49は低域通過フィルタ51を通過し、出力信号53が積分器55によって平均化されて、I信号57となる。被測定信号源41の出力信号43と、 $+90$ 度位相シフタ45の出力信号46は、乗算器48において乗算され、その出力信号50は低域通過フィルタ52を通過し、出力信号54が積分器56によって平均化されて、Q信号58となる。

【0005】基準信号源42の出力信号44に対する、被測定信号源41の出力信号43の位相を θ とすると、位相 θ の変化に伴い、I信号57は $\cos \theta$ 、Q信号58は $\sin \theta$ に比例した変化をする。したがって、 $\theta = \arctan(\sin \theta / \cos \theta)$ より、位相 θ を求めることができる。

【0006】乗算器47の出力信号49には、信号43と信号44の周波数の和と差の信号が出力される。乗算器48の出力信号50には、信号43と信号46の周波数の和と差の信号が出力される。積分器55、積分器56で積分したい信号は、差の周波数の信号のみである。和の周波数の信号が積分器55、積分器56に入力されると、積分時間が和の周波数の信号の1周期の整数倍でない場合は、積分結果に誤差が生ずる。

【0007】被測定信号源41と基準信号源42が、周波数の変化を伴う変調波の場合は、積分周期を和の周波数の1周期の整数倍にすることはほとんど不可能である。そこで、従来は、和の周波数の信号を除去するため、低域通過フィルタ51と低域通過フィルタ52が挿入されていた。

【0008】ここで、パルス信号の振幅、位相を測定すると、I信号57とQ信号58は立ち上がり、立ち下りの急峻なパルス信号になる。低域通過フィルタ51、52を挿入すると、フィルタ51、52の時定数により、パルス立ち上がり、立ち下がりが緩やかになるなど、波形歪を生ずる。そのため、高速なパルス信号を測定することは困難であった。

【0009】

【発明が解決しようとする課題】上述した従来の直交検波器は、乗算器で発生し、積分器に入力される高周波信号が積分誤差の原因となり、測定精度に影響を与えるという欠点があった。

【0010】本発明の目的は、波形歪の原因となるフィルタを使用することなく、積分器に高周波信号が入力されないようにした直交検波器を提供することにある。

【0011】

【課題を解決するための手段】本発明の直交検波器は、被測定信号源の出力信号の位相を -90 度シフトする -90 度位相シフタと、基準信号源の出力信号の位相を+

90度シフトする+90度位相シフタと、前記被測定信号源の出力信号と前記基準信号源の出力信号を乗算する第1の乗算器と、前記-90度位相シフタの出力信号と前記+90度位相シフタの出力信号を乗算する第2の乗算器と、前記-90度位相シフタの出力信号と前記基準信号源の出力信号を乗算する第3の乗算器と、前記被測定信号源の出力信号と前記+90度位相シフタの出力信号を乗算する第4の乗算器と、第1の乗算器の出力信号と第2の乗算器の出力信号の差信号を出力する第1の加算器と、第3の乗算器の出力信号と第4の乗算器の出力信号の和信号を出力する第2の加算器と、第1の加算器の出力信号を平均化する第1の積分器と、第2の加算器の出力信号を平均化する第2の積分器を有する。

【0012】本発明の他の直交検波器は、被測定信号源の出力信号の位相を-90度シフトする第1の-90度位相シフタと、基準信号源の出力信号の位相を-90度シフトする第2の-90度位相シフタと、前記被測定信号源の出力信号と前記基準信号源の出力信号を乗算する第1の乗算器と、前記第1の-90度位相シフタの出力信号と前記第2の-90度位相シフタの出力信号を乗算する第2の乗算器と、前記第1の-90度位相シフタの出力信号と前記基準信号源の出力信号を乗算する第3の乗算器と、前記被測定信号源の出力信号と前記第2の-90度位相シフタの出力信号を乗算する第4の乗算器と、第1の乗算器の出力信号と第2の乗算器の出力信号の和信号を出力する第1の加算器と、第3の乗算器の出力信号と第4の乗算器の出力信号の差信号を出力する第2の加算器と、第1の加算器の出力信号を平均化する第1の積分器と、第2の加算器の出力信号を平均化する第2の積分器を有する。

【0013】本発明は、直交検波器の乗算器出力に現れる、乗算器入力信号の周波数に対する差の信号と和の信号のうち、和の信号を除去する目的のために、三角関数の性質を利用して、差の信号を倍増し、和の信号を相殺するような信号を別に加えることにより、フィルタを使用せずに和の信号を除去し、波形歪の生じない、高速な*

$$\begin{aligned}\text{信号23: } s_{23}(t) &= s_{13}(t) \cdot s_{14}(t) \\ &= [\cos(\theta_m - \theta_r) + \cos(2\omega t + \theta_m + \theta_r)]/2 \\ \text{信号24: } s_{24}(t) &= s_{16}(t) \cdot s_{18}(t) \\ &= -[\cos(\theta_m - \theta_r) - \cos(2\omega t + \theta_m + \theta_r)]/2 \\ \text{信号29: } s_{29}(t) &= s_{23}(t) - s_{24}(t) = \cos(\theta_m - \theta_r)\end{aligned}$$

【0022】信号14と信号16は、乗算器21において乗算され、出力信号25を得る。信号13と信号18は、乗算器22において乗算され、出力信号26を得る。信号25と信号26は、加算器28において加算さ

*パルス信号の直交検波を可能にするとともに、和の信号による積分誤差を除去することを可能にしたものである。

【0014】

【発明の実施の形態】次に、本発明の実施の形態について図面を参照して説明する。

【0015】図1は本発明の一実施形態の直交検波器の構成図である。

【0016】本実施形態の直交検波器は、-90度位相シフタ15と、+90度位相シフタ17と、乗算器19、20、21、22と、加算器27、28と、積分器31、32で構成されている。

【0017】次に、本実施形態の動作を説明する。

【0018】被測定信号源11の出力信号13は、乗算器19に入力される信号13と、-90度位相シフタ15によって-90度位相がシフトされた出力信号16に分配される。基準信号源12の出力信号14は、乗算器21に入力される信号14と、+90度位相シフタによって+90度位相がシフトされた出力信号18に分配される。各信号を式で表すと、以下のようになる。

【0019】

【数1】

$$\begin{aligned}\text{信号13: } s_{13}(t) &= \cos(\omega t + \theta_m) \\ \text{信号16: } s_{16}(t) &= \cos(\omega t + \theta_m - \pi/2) = \sin(\omega t + \theta_m) \\ \text{信号14: } s_{14}(t) &= \cos(\omega t + \theta_r) \\ \text{信号18: } s_{18}(t) &= \cos(\omega t + \theta_r + \pi/2) = -\sin(\omega t + \theta_r)\end{aligned}$$

【0020】信号13と信号14は、乗算器19において乗算され、出力信号23を得る。信号16と信号18は、乗算器20において乗算され、出力信号24を得る。信号23と信号24は、加算器27において減算され、出力信号29を得る。この処理過程を式で表すと、以下のようになる。

【0021】

【数2】

れ、出力信号30を得る。この処理過程を式で表すと、以下のようになる。

【0023】

【数3】

$$\begin{aligned} \text{信号23: } s_{23}(t) &= s_{13}(t) \cdot s_{14}(t) \\ &= [\cos(\theta_m - \theta_r) + \cos(2\omega t + \theta_m + \theta_r)] / 2 \end{aligned}$$

$$\begin{aligned} \text{信号24: } s_{24}(t) &= s_{18}(t) \cdot s_{18}(t) \\ &= -[\cos(\theta_m - \theta_r) - \cos(2\omega t + \theta_m + \theta_r)] / 2 \end{aligned}$$

$$\text{信号29: } s_{29}(t) = s_{23}(t) - s_{24}(t) = \cos(\theta_m - \theta_r)$$

【0024】乗算器19、20、21、22の出力信号23、24、25、26には信号源11、12の周波数の和、すなわち 2ω の信号が含まれるが、加算器27、28における演算で 2ω の信号は相殺され、加算器27、28の出力信号29、30には信号源11、12の周波数の差の信号のみが現れる。加算器27の出力信号29は積分器31で平均化され、I信号33となる。加算器28の出力信号30は積分器32で平均化され、Q信号34となる。

【0025】積分器31、32に入力される信号29、30には高周波信号が含まれないので、高周波信号による積分誤差は生じない。また、高周波信号の除去に低域通過フィルタを使用しないため、フィルタによるI信号33、Q信号34への波形歪は生じない。

【0026】図1の+90度位相シフタ17は、90度位相進みであるため、遅延素子での実現は不可能である。+90度位相シフタ17を-90度位相シフタに変更し、90度位相遅れにすると、信号18、24、26の振幅の符号が反転する。この場合、加算器27における演算を、信号23と信号24の和に、また加算器28における演算を、信号25から信号26を引く減算に変更することによって、変更前と同じ効果が得られる。

【0027】

【発明の効果】以上説明したように、本発明は、三角関数の性質を利用して、差の信号を増幅し、和の信号を相殺するような信号を別に加えることにより、フィルタを*

*使用せずに和の信号を除去し、波形歪の生じない、高速なパルス信号の直交検波が可能になる効果がある。

【図面の簡単な説明】

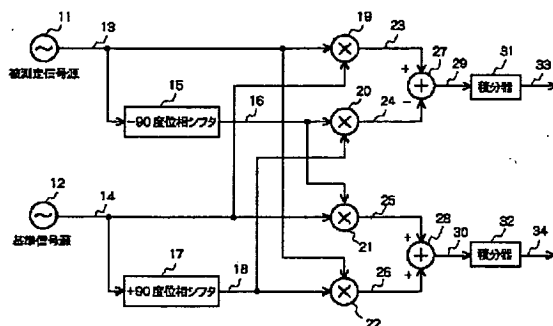
【図1】本発明の一実施形態の直交検波器の構成図である。

【図2】直交検波器の従来例の構成図である。

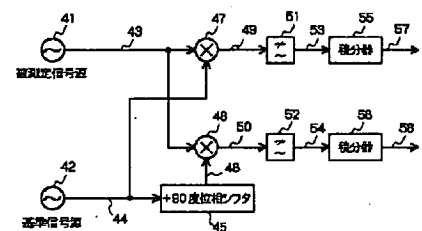
【符号の説明】

- 11 被測定信号源
- 12 基準信号源
- 13 被測定信号源11の出力信号
- 14 基準信号源12の出力信号
- 15 -90度位相シフタ
- 16 -90度位相シフタ15の出力信号
- 17 +90度位相シフタ
- 18 +90度位相シフタ17の出力信号
- 19~22 乗算器
- 23 乗算器19の出力信号
- 24 乗算器20の出力信号
- 25 乗算器21の出力信号
- 26 乗算器22の出力信号
- 27、28 加算器
- 29 加算器27の出力信号
- 30 加算器28の出力信号
- 31、32 積分器
- 33 積分器31の出力信号
- 34 積分器32の出力信号

【図1】



【図2】



【手続補正書】

【提出日】平成8年7月22日

*【補正内容】

【手続補正1】

【0023】

【補正対象書類名】明細書

【数3】

【補正対象項目名】0023

【補正方法】変更

*

$$\begin{aligned} \text{信号25: } s_{25}(t) &= s_{14}(t) \cdot s_{16}(t) \\ &= [\sin(\theta_m - \theta_r) + \sin(2\omega t + \theta_m + \theta_r)] / 2 \end{aligned}$$

$$\begin{aligned} \text{信号26: } s_{26}(t) &= s_{13}(t) \cdot s_{18}(t) \\ &= [\sin(\theta_m - \theta_r) - \sin(2\omega t + \theta_m + \theta_r)] / 2 \end{aligned}$$

$$\text{信号30: } s_{30}(t) = s_{25}(t) + s_{26}(t) = \sin(\theta_m - \theta_r)$$

* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] About -90 degrees which shifts the phase of the output signal of the source of a measurement signal-ed -90 degrees A phase shifter, About +90 degrees which shifts the phase of the output signal of the source of a reference signal +90 degrees A phase shifter, The 1st multiplier which carries out the multiplication of the output signal of said source of a measurement signal-ed, and the output signal of said source of a reference signal, The aforementioned output signal of a phase shifter and the 2nd aforementioned multiplier of the above which carries out the multiplication of the output signal of a phase shifter about +90 degrees about -90 degrees, The 3rd multiplier of the above which carries out the multiplication of the output signal of a phase shifter, and the output signal of said source of a reference signal about -90 degrees, The output signal of said source of a measurement signal-ed, and the 4th multiplier of the above which carries out the multiplication of the output signal of a phase shifter about +90 degrees, The 1st adder which outputs the difference signal of the output signal of the 1st multiplier, and the output signal of the 2nd multiplier, The rectangular wave detector which has the 2nd adder which outputs the sum signal of the output signal of the 3rd multiplier, and the output signal of the 4th multiplier, the 1st integrator which equalizes the output signal of the 1st adder, and the 2nd integrator which equalizes the output signal of the 2nd adder.

[Claim 2] The one to 90th [about] degree which shifts the phase of the output signal of the source of a measurement signal-ed -90 degrees A phase shifter, The two to 90th [about] degree which shifts the phase of the output signal of the source of a reference signal -90 degrees A phase shifter, The 1st multiplier which carries out the multiplication of the output signal of said source of a measurement signal-ed, and the output signal of said source of a reference signal, Said said 2nd multiplier which carries out the multiplication of the output signal of a phase shifter to the output signal of a phase shifter the two to 90th [about] degree the one to 90th [about] degree, Said 3rd multiplier which carries out the multiplication of the output signal of a phase shifter, and the output signal of said source of a reference signal the one to 90th [about] degree, Said 4th multiplier which carries out the multiplication of the output signal of a phase shifter to the output signal of said source of a measurement signal-ed the two to 90th [about] degree, The 1st adder which outputs the sum signal of the output signal of the 1st multiplier, and the output signal of the 2nd multiplier, The rectangular wave detector which has the 2nd adder which outputs the difference signal of the output signal of the 3rd multiplier, and the output signal of the 4th multiplier, the 1st integrator which equalizes the output signal of the 1st adder, and the 2nd integrator which equalizes the output signal of the 2nd adder.

[Translation done.]

* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the rectangular wave detector used for measurement of the amplitude and a phase.

[0002]

[Description of the Prior Art] Drawing 2 is the block diagram of the conventional rectangular wave detector.

[0003] There is a source 42 of a reference signal of the same frequency as the source 41 of a measurement signal-ed. The output signal 44 of the source 42 of a reference signal is distributed to the signal inputted into a multiplier 47, and the output signal 46 with which the phase was shifted by the phase shifter 45 about +90 degrees about +90 degrees.

[0004] In a multiplier 47, the multiplication of the output signal 43 of the source 41 of a measurement signal-ed and the output signal 44 of the source 42 of a reference signal is carried out, the output signal 49 passes a low pass filter 51, an output signal 53 is equalized by the integrator 55, and they turn into I signal 57. The output signal 43 of the source 41 of a measurement signal-ed, and about +90 degrees, in a multiplier 48, the multiplication of the output signal 46 of the phase shifter 45 is carried out, the output signal 50 passes a low pass filter 52, an output signal 54 is equalized by the integrator 56, and it turns into Q signal 58.

[0005] If the phase of the output signal 43 of the source 41 of a measurement signal-ed to the output signal 44 of the source 42 of a reference signal is set to theta, change in which I signal 57 was proportional to $\cos\theta$, and Q signal 58 is proportional to $\sin\theta$ will be carried out with change of a phase theta. Therefore, it can ask for a phase theta from $\theta = \arctan(\sin\theta / \cos\theta)$.

[0006] The sum of the frequency of a signal 43 and a signal 44 and the signal of a difference are outputted to the output signal 49 of a multiplier 47. The sum of the frequency of a signal 43 and a signal 46 and the signal of a difference are outputted to the output signal 50 of a multiplier 48. A signal to integrate an integrator 55 and an integrator 56 is only a signal of the frequency of a difference. If the signal of a peace frequency is inputted into an integrator 55 and an integrator 56, when the reset time is not the integral multiple of one period of the signal of a peace frequency, an error arises in an integral result.

[0007] In the case of the modulated wave accompanied by change of a frequency in the source 41 of a measurement signal-ed, and the source 42 of a reference signal, it is almost impossible for making an integral period into the integral multiple of one period of a peace frequency. Then, in order to remove the signal of a peace frequency conventionally, the low pass filter 51 and the low pass filter 52 were inserted.

[0008] Here, if the amplitude of a pulse signal and a phase are measured, I signal 57 and Q signal 58 will start, and will turn into a steep pulse signal of falling. Insertion of low pass filters 51 and 52 produces waveform distortion with the time constant of filters 51 and 52 -- a pulse standup and falling become loose. Therefore, it was difficult to measure a high-speed pulse signal.

[0009]

[Problem(s) to be Solved by the Invention] It generated with the multiplier, the RF signal inputted into an integrator caused an integral error, and the conventional rectangular wave detector mentioned above had the fault of affecting the accuracy of measurement.

[0010] The object of this invention is to offer the rectangular wave detector which the RF signal was made not to be inputted into an integrator, without using the filter leading to waveform distortion.

[0011]

[Means for Solving the Problem] The rectangular wave detector of this invention about -90 degrees which shifts the phase of the output signal of the source of a measurement signal-ed -90 degrees A phase shifter, About +90 degrees which shifts the phase of the output signal of the source of a reference signal +90 degrees A phase shifter, The 1st multiplier which carries out the multiplication of the output signal of said source of a

measurement signal-ed, and the output signal of said source of a reference signal, The aforementioned output signal of a phase shifter and the 2nd aforementioned multiplier of the above which carries out the multiplication of the output signal of a phase shifter about +90 degrees about -90 degrees, The 3rd multiplier of the above which carries out the multiplication of the output signal of a phase shifter, and the output signal of said source of a reference signal about -90 degrees, The output signal of said source of a measurement signal-ed, and the 4th multiplier of the above which carries out the multiplication of the output signal of a phase shifter about +90 degrees, The 1st adder which outputs the difference signal of the output signal of the 1st multiplier, and the output signal of the 2nd multiplier, It has the 2nd adder which outputs the sum signal of the output signal of the 3rd multiplier, and the output signal of the 4th multiplier, the 1st integrator which equalizes the output signal of the 1st adder, and the 2nd integrator which equalizes the output signal of the 2nd adder.

[0012] Other rectangular wave detectors of this invention the one to 90th [about] degree which shifts the phase of the output signal of the source of a measurement signal-ed -90 degrees A phase shifter, The two to 90th [about] degree which shifts the phase of the output signal of the source of a reference signal -90 degrees A phase shifter, The 1st multiplier which carries out the multiplication of the output signal of said source of a measurement signal-ed, and the output signal of said source of a reference signal, Said 2nd multiplier which carries out the multiplication of the output signal of a phase shifter to the output signal of a phase shifter the two to 90th [about] degree the one to 90th [about] degree, Said 3rd multiplier which carries out the multiplication of the output signal of a phase shifter, and the output signal of said source of a reference signal the one to 90th [about] degree, Said 4th multiplier which carries out the multiplication of the output signal of a phase shifter to the output signal of said source of a measurement signal-ed the two to 90th [about] degree, The 1st adder which outputs the sum signal of the output signal of the 1st multiplier, and the output signal of the 2nd multiplier, It has the 2nd adder which outputs the difference signal of the output signal of the 3rd multiplier, and the output signal of the 4th multiplier, the 1st integrator which equalizes the output signal of the 1st adder, and the 2nd integrator which equalizes the output signal of the 2nd adder.

[0013] This invention for the object which removes the signal of the difference over the frequency of the multiplier input signal which appears in the multiplier output of a rectangular wave detector, and the signal of the sum among peace signals While enabling rectangular detection of a high-speed pulse signal which doubles the signal of a difference, and removes a peace signal using the property of a trigonometric function, without using a filter by adding independently a signal which offsets a peace signal, and waveform distortion does not produce It makes it possible to remove the integral error by the peace signal.

[0014]

[Embodiment of the Invention] Next, the gestalt of operation of this invention is explained with reference to a drawing.

[0015] Drawing 1 is the block diagram of the rectangular wave detector of 1 operation gestalt of this invention.

[0016] The rectangular wave detector of this operation gestalt consists of the phase shifter 17, multipliers 19, 20, 21, and 22, adders 27 and 28, and integrators 31 and 32 about +90 degrees with the phase shifter 15 about -90 degrees.

[0017] Next, actuation of this operation gestalt is explained.

[0018] At least -90 degree is distributed at least for -90 phase shifters to the output signal 16 with which the phase was shifted by 15 with the signal 13 with which the output signal 13 of the source 11 of a measurement signal-ed is inputted into a multiplier 19. The output signal 14 of the source 12 of a reference signal is distributed to the signal 14 inputted into a multiplier 21, and the output signal 18 with which the phase was shifted by the phase shifter about +90 degrees about +90 degrees. It is as follows when each signal is expressed with a formula.

[0019]

[Equation 1]

信号 13 : $s_{13}(t) = \cos(\omega t + \theta_m)$

信号 16 : $s_{16}(t) = \cos(\omega t + \theta_m - \pi/2) = \sin(\omega t + \theta_m)$

信号 14 : $s_{14}(t) = \cos(\omega t + \theta_r)$

信号 18 : $s_{18}(t) = \cos(\omega t + \theta_r + \pi/2) = -\sin(\omega t + \theta_r)$

[0020] In a multiplier 19, the multiplication of a signal 13 and the signal 14 is carried out, and they acquire an output signal 23. In a multiplier 20, the multiplication of a signal 16 and the signal 18 is carried out, and they acquire an output signal 24. A signal 23 and a signal 24 are subtracted in an adder 27, and acquire an output signal 29. It is as follows when this processing process is expressed with a formula.

[0021]

[Equation 2]

$$\begin{aligned} \text{信号 23 : } s_{23}(t) &= s_{13}(t) \cdot s_{14}(t) \\ &= [\cos(\theta_m - \theta_r) + \cos(2\omega t + \theta_m + \theta_r)] / 2 \end{aligned}$$

$$\begin{aligned} \text{信号 24 : } s_{24}(t) &= s_{18}(t) \cdot s_{18}(t) \\ &= -[\cos(\theta_m - \theta_r) - \cos(2\omega t + \theta_m + \theta_r)] / 2 \end{aligned}$$

$$\text{信号 29 : } s_{29}(t) = s_{23}(t) - s_{24}(t) = \cos(\theta_m - \theta_r)$$

[0022] In a multiplier 21, the multiplication of a signal 14 and the signal 16 is carried out, and they acquire an output signal 25. In a multiplier 22, the multiplication of a signal 13 and the signal 18 is carried out, and they acquire an output signal 26. A signal 25 and a signal 26 are added in an adder 28, and acquire an output signal 30. It is as follows when this processing process is expressed with a formula.

[0023]

[Equation 3]

$$\begin{aligned} \text{信号 23 : } s_{23}(t) &= s_{13}(t) \cdot s_{14}(t) \\ &= [\cos(\theta_m - \theta_r) + \cos(2\omega t + \theta_m + \theta_r)] / 2 \end{aligned}$$

$$\begin{aligned} \text{信号 24 : } s_{24}(t) &= s_{18}(t) \cdot s_{18}(t) \\ &= -[\cos(\theta_m - \theta_r) - \cos(2\omega t + \theta_m + \theta_r)] / 2 \end{aligned}$$

$$\text{信号 29 : } s_{29}(t) = s_{23}(t) - s_{24}(t) = \cos(\theta_m - \theta_r)$$

[0024] Although the sum of the frequency of the sources 11 and 12 of a signal, i.e., a 2omega signal, is contained in the output signals 23, 24, 25, and 26 of multipliers 19, 20, 21, and 22, a 2omega signal is offset by the operation in adders 27 and 28, and only the signal of the difference of the frequency of the sources 11 and 12 of a signal appears in the output signals 29 and 30 of adders 27 and 28. The output signal 29 of an adder 27 is equalized with an integrator 31, and turns into I signal 33. The output signal 30 of an adder 28 is equalized with an integrator 32, and turns into Q signal 34.

[0025] Since a RF signal is not included in the signals 29 and 30 inputted into integrators 31 and 32, the integral error by the RF signal is not produced. Moreover, in order not to use a low pass filter for clearance of a RF signal, the waveform distortion to I signal 33 with a filter and Q signal 34 is not produced.

[0026] About +90 degrees of drawing 1, about 90 degrees, since the phase shifter 17 is phase progress, it is impossible for the implementation by the delay element. + If at least -90 phase shifters change 17 into a phase shifter and are made into phase delay about 90 degrees about 90 degrees, the sign of the amplitude of signals 18, 24, and 26 will be reversed. In this case, the same effectiveness as modification before is acquired by changing an operation [in / for the operation in an adder 27 / an adder 28] into subtraction which lengthens a signal 26 from a signal 25 again at the sum of a signal 23 and a signal 24.

[0027]

[Effect of the Invention] As explained above, by amplifying the signal of a difference and adding independently a signal which offsets a peace signal using the property of a trigonometric function, this invention removes a peace signal, without using a filter, and is effective in rectangular detection of a high-speed pulse signal which waveform distortion does not produce being attained.

[Translation done.]

* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.*** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram of the rectangular wave detector of 1 operation gestalt of this invention.

[Drawing 2] It is the block diagram of the conventional example of a rectangular wave detector.

[Description of Notations]

11 Source of Measurement Signal-ed

12 Source of Reference Signal

13 Output Signal of Source 11 of Measurement Signal-ed

14 Output Signal of Source 12 of Reference Signal

15 It is Phase Shifter about -90 Degrees.

16 It is Output Signal of Phase Shifter 15 about -90 Degrees.

17 It is Phase Shifter about +90 Degrees.

18 It is Output Signal of Phase Shifter 17 about +90 Degrees.

19-22 Multiplier

23 Output Signal of Multiplier 19

24 Output Signal of Multiplier 20

25 Output Signal of Multiplier 21

26 Output Signal of Multiplier 22

27 28 Adder

29 Output Signal of Adder 27

30 Output Signal of Adder 28

31 32 Integrator

33 Output Signal of Integrator 31

34 Output Signal of Integrator 32

[Translation done.]

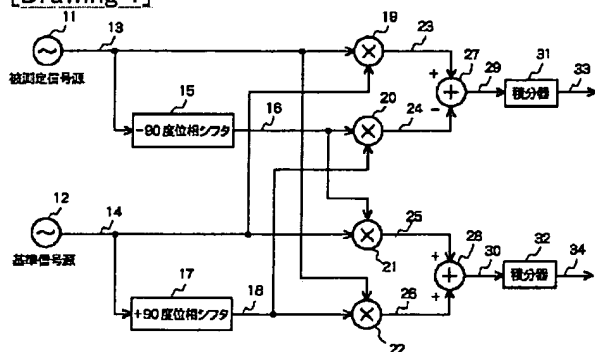
* NOTICES *

JP0 and NCIPi are not responsible for any damages caused by the use of this translation.

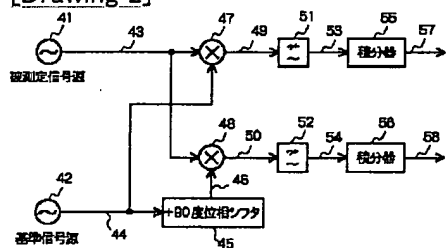
- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.*** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]